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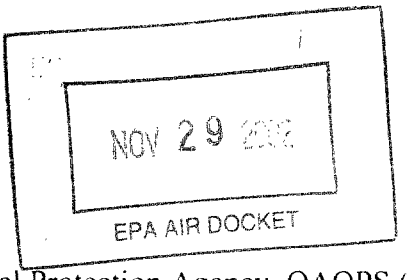

MEMORANDUM

TO: Jim Eddinger, U.S. Environmental Protection Agency, OAQPS (C439-01)

FROM: Jeanette Alvis and Christy Burlew, Eastern Research Group (ERG), Morrisville

DATE: October, 2002

SUBJECT: Development of the Emissions Test Database for the Industrial/Commercial/Institutional Boilers and Process Heaters National Emission Standard for Hazardous Air Pollutants

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1.0 INTRODUCTION

This memorandum describes the development of the boiler emissions test database from the Industrial Combustion Coordinated Rulemaking (ICCR) Emissions Test Database version 5.0. The data sources and development of the ICCR Emissions Test Database version 5.0 are described in the memorandum *Sources and Extraction of Data from Emissions Test Reports and Emissions Data Conversions and Calculations Used to Develop Versions 4.3, 4.4 and 5.0 of the Emissions Test Database.*[1] Descriptions of tables and fields in the ICCR Emissions Test Database version 5.0 can be found in the memorandum *Data Dictionary for the ICCR Emissions Test Database.*[2] The complete boiler emissions test database can be found in docket item II-B-2 on CD-ROM.

Section 2.0 describes the sources of the emission tests and the types of emissions and boiler data that are available in the boiler emissions test database. Section 3.0 describes the modifications made to version 5.0 of the ICCR emissions test database in order to include emission factors for non-detect data in the boiler emissions test database. Section 3.0 also describes the addition of new boiler test data to the boiler emissions test database. Section 4.0 identifies test reports or portions of test reports included in the boiler emissions test database that were not included in subsequent boiler analysis.

2.0 AVAILABLE EMISSIONS AND BOILER DATA

The boiler emissions test database contains data from 345 emission test reports representing approximately 221 different facilities or test sites. These test reports were gathered from the following sources:

- EPA Stack Test Information Retrieval System (STIRS) - 45 reports;
- EPA Compilation of Air Pollutant Emission Factors (AP-42) - 53 reports;
- EPA Utility Boiler Docket - 14 reports;
- the California Air Resources Board (CARB) - 26 reports;
- ICCR Survey Recipients - 190 reports;
- trade associations - 3 reports;
- previous EPA collection efforts - 2 reports;
- Michigan Department of Environmental Quality - 2 reports; and
- Miscellaneous - 10 reports

Except for test reports from the Utility Boiler Docket, these test reports represent industrial boilers. Tests for utility boilers were included in the boiler emissions test database under the assumption that utility boilers burn the same types of fuels, have similar designs, and utilize many of the same control devices as industrial boilers. Because of these similarities, emissions from utility boilers are expected to be representative of emissions from industrial boilers.

As noted in Section 1.0, the memorandum *Data Dictionary for the ICCR Emissions Test Database*[2] contains a detailed discussion of the format and types of information in the ICCR emissions test database version 5.0. Therefore, this memorandum only briefly discusses some of the relevant information in the boiler emissions test database. The boiler emissions test database is a Microsoft Access relational database that includes three data tables, named "Equipment", "Corrected Test Data", and "Run Data", and two reference tables.

Information specific to the test site/facility, boiler, fuel type, and controls is included in the "Equipment" table. Data that are specific to the test site include facility name, facility location, and testing company. Unit level data include boiler capacity, unit description, and

operating rate. Data are also available concerning the fuels which are combusted by boilers during the emission tests. These data include fuel type, higher heating value, and heat input in million British thermal units per hour (MMBtu/hr). Control device information includes the type of control device, device description, manufacturer, and airflow data. All data fields in the "Equipment" table are presented in Attachment A-1.

Information included in the database specific to individual test runs is included in the "Corrected Test Data" and "Run Data" tables. The "Corrected Test Data" table contains information specific to the emissions results per test run, while the "Run Data" table contains information pertaining to the operating conditions during each test run. Data available in the "Corrected Test Data" table include the pollutants tested, test methods, raw data concentrations, and raw units of measure as well as calculated per-run and average run concentrations in standard units of measure (parts per billion at three percent Oxygen, micrograms per dry standard cubic meter at three percent Oxygen, or microCuries per dry standard cubic meter at three percent Oxygen) and calculated per-run and average run emission factors in lb/MMBtu. An average run concentration is the average of concentrations for three test runs and an average run emission factor is the average of emission factors for three test runs. Data available in the "Run Data" table include oxygen level, exhaust flowrate, operating rate, and exhaust temperature. The data fields in the "Corrected Test Data" and "Run Data" tables are presented in Attachments A-2 and A-3, respectively.

3.0 ADDITIONAL BOILER EMISSIONS TEST DATA

3.1 Additional Non-Detect Raw Data

The ICCR emissions test database version 5.0 provided calculated average run pollutant concentrations in standard units of measure at three and seven percent O_2 and average run emission factors in lb/MMBtu for tests which had at least one raw data point above the detection limit and had all other necessary data to perform the calculations. Records for tests which had only non-detect raw data points were included in the ICCR emissions test database version 5.0 but calculated average run pollutant concentrations or average run emission factors were not developed for these records. Consequently, the ICCR emissions test database version 5.0 was biased toward higher emission rates because it did not include standardized average run

concentrations or average run emission factors for the lower emission rates represented by the non-detect data. In order to be more accurate and representative of actual emissions from boilers, emission factors were calculated incorporating previously unused non-detect data to ensure that analyses based on the boiler emissions test database did not result in overestimates of average pollutant concentrations or emission factors. The records in the boiler emissions test database for tests with only non-detect raw data points were modified to include calculated average run pollutant concentrations in standard units of measure and calculated average run emission factors in lb/MMBtu. In the cases where all test runs were non-detect, one-half of the non-detect values were used to calculate the average run pollutant concentrations and average run emission factors. This is consistent with how non-detect values were used in the ICCR emissions test database version 5.0 for tests with one or two non-detect runs and at least one value above the detection limit and is also consistent with the methodology of AP-42. Further information on the calculation of average pollutant concentrations and emission factors in version 5.0 of the ICCR emissions test database is found in the memorandum *Emissions Data Conversions and Calculations in the ICCR Emissions Test Database.*[3]

3.2 New Boiler Emissions Test Data

Sixteen emission test reports not previously reviewed for inclusion in the ICCR emissions test database version 5.0 were reviewed for additional boiler emission test data. These particular emission tests were reviewed to provide additional emissions test data for metals, particulate matter, and hydrochloric acid resulting from the combustion of fuel oil in boilers. These reports provided new data for 15 pollutants. The raw data and all the necessary operating data were extracted from the test reports, entered into a database, and used to calculate average concentrations and emission factors in the same manner as for the ICCR emissions test database version 5.0.

4.0 TESTS OR PORTIONS OF TESTS NOT USED IN ANALYSES

The boiler emissions test database includes a lookup table named "LOOKUP: Tests/Data Not Used in Analysis" that identifies specific tests or portions of tests that were not used in subsequent data analysis. Many of these tests are for municipal waste combustors and therefore

are not applicable to industrial boilers. Some tests are identified as having errors in the data entry or data conversions. Other tests are listed as having non-detect data of higher values than detect data for a similar boiler. The tests in this lookup table were not removed from the boiler emissions test database. A description of how these particular tests were identified and handled in subsequent analysis are provided in the memorandum *Development of Average Emission Factors and Baseline Emission Estimates for the Industrial, Commercial, and Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants.*[4]

5.0 REFERENCES

1. Jack Johnson, ERG. Memorandum to Fred Porter, EPA/ESD. *Sources and Extraction of Data from Emissions Test Reports and Emissions Data Conversions and Calculations Used to Develop Versions 4.3, 4.4 and 5.0 of the Emissions Test Database.* June 25, 1999.

2. Jack Johnson, ERG. Memorandum to Fred Porter, EPA/ESD. *Data Dictionary for the ICCR Emissions Test Database.* June 25, 1999.

3. Jack Johnson, ERG. Memorandum to Fred Porter, EPA/ESD. *Emissions Data Conversions and Calculations in the ICCR Emissions Test Database.* June 25, 1999.

4. Christy Presson Burlew, ERG. Memorandum to Jim Eddinger, U.S. Environmental Protection Agency, OAQPS. *Development of Average Emission Factors and Baseline Emission Estimates for the Industrial, Commercial, and Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants.* October, 2002.

Attachment A-1
Data Fields in Equipment Table

TIF ID
ID
Facility Name
Facility ID
Location
Testing Company
Date
Unit ID
Manufacturer
Model
Unit Description
Air Supply
Capacity
Capacity Units
Operating Rate
Operating Rate Unit
Fuel Type
Conversion Factor (dscf/MMBtu)
Conversion Factor Basis
HHV
HHVUnit
Heat Input (MMBtu/hr)
B or A Control
Control Code
Unit Type
Comments
Additional Fuel Info
Additional Capacity Info
Additional Control Info
Control Device Description
Source
Data Date

Attachment A-2
Data Fields in Corrected Test Data Table

ID
Pollutant
CAS
MW
HAP
Metal/NonMetal
Test Method
Run 1 Conc
Run1ND
Run 2 Conc
Run2ND
Run 3 Conc
Run3ND
CUnit
Run 1 Train Volume
Run 2 Train Volume
Run 3 Train Volume
Train Volume Units
NewRunConc1
NewRunConc2
NewRunConc3
NewConcUnits
AvgNewRunConc
CommentAvgNewRunConc
NewRunConc1(7%O2)
NewRunConc2(7%O2)
NewRunConc3(7%O2)
AvgNewRunConc(7%O2)
NewConcUnits(7%O2)
CommentAvgNewRunConc(7%O2)
Run1 EF (lb/MMBtu)
Run2 EF (lb/MMBtu)
Run3 EF (lb/MMBtu)
AvgEmissFactNew
CommentAvgEmissFactNew
Comment
CombineRuns
AvgRunND
AvgComments
AvgRunND7%
AvgComments7%

Attachment A-3
Data Fields in Run Data Table

ID
Run 1 O2 (%)
Run 2 O2 (%)
Run 3 O2 (%)
EXH 1 (dscfm)
EXH 2 (dscfm)
EXH 3 (dscfm)
EXH Units
Standard Temperature
Standard Temperature Unit
Run 1 Fuel Flowrate
Run 2 Fuel Flowrate
Run 3 Fuel Flowrate
Fuel Flowrate Unit
Run 1 Operating Rate
Run 2 Operating Rate
Run 3 Operating Rate
Operating Rate Unit
Run 1 Fraction Moisture
Run 2 Fraction Moisture
Run 3 Fraction Moisture
Run 1 Exhaust Temp
Run 2 Exhaust Temp
Run 3 Exhaust Temp
Comments